1:45 PM

Parameters Affecting Postoperative Success of Surgery for Stage 4a/4b ROP

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- CEMAL OZSAYGILI, MD
- Mehmet C Ozmen, MD
- DUYGU YALINBAS, MD
- Hatice Tuba Atalay

OBJECTIVE Vitreoretinal surgery for stage 4A/4B ROP has diverse results and this study is performed to analyse the preop and perop and postoperative parameters affecting the anatomical and fucntional outcomes.

PURPOSE To describe the long term anatomical and functional results of surgery for retinal detachment associated with stage 4 retinopathy of prematurity (ROP) and patient and surgery related factors affecting postoperative success.

METHODS This is a Retrospective case series at a single tertiary referral pediatric VRS practice. 125 eyes of 86 infants who underwent lens-sparing vitrectomy (LSV) or vitrectomy with lensectomy (LV) surgery for stage 4A and 4B ROP in Gazi University between 2011 and 2016 were enrolled in this study. Patient's demographic characteristics, stage of ROP, preoperative treatment status, anatomical and functional outcome and complications were recorded. The effect of birth weight/age, presence of plus disease, preoperative treatment status, induction of posterior hyaloid detachment, postoperative vitreous hemorrhage and iatrogenic retinal tear on anatomical and functional results were evaluated.

RESULTS 60.8% of the eyes were stage 4A and 39.2% were stage 4B ROP. The mean follow-up was 22.6 months. 17.6% of the eyes had no preoperative treatment. Anatomical success was 85.5% for stage 4A and 67.3% for stage 4B at the 1st year and 95.8% for stage 4A and 57.9% for stage 4B at the 3rd year. Functional success was 86.8% for stage 4A, 63.2% for stage 4B at the 1st year and 87.5% for stage 4A and 57.8% for stage 4B at the 3rd year. The mean visual acuity was 1.12±0.34 LogMAR for stage 4A and 1.34±0.32 LogMAR at the 3-year follow up. There was preoperative plus disease in 59.2% of the eyes. Subsequent retinal surgeries were required in 17.7% of the eyes. Presence of plus disease and absence of preoperative treatment, iatrogenic retinal tear formation and postoperative vitreous hemorrhage were found to have significant negative effects, while, surgical induction of posterior hyaloid detachment and sparing the lens intraoperatively affected the anatomical and functional results positively.

CONCLUSION Surgery for stage 4 ROP associated RD resulted in encouraging anatomical and functional outcomes and the results are even better in eyes with preoperative (laser/anti-VEGF) treatment, LSV and surgically induced posterior hyaloid detachment.

1:53 PM

ROP Screening With Ultra-widefield Imaging

- Guillermo Salcedo-Villanueva, MD
- Raul Velez-Montoya, MD
- Gerardo Garcia-Aguirre, MD
- Virgilio Morales-Canton, MD
- Maria A. Martinez-Castellanos, MD
- Hugo Quiroz-Mercado, MD

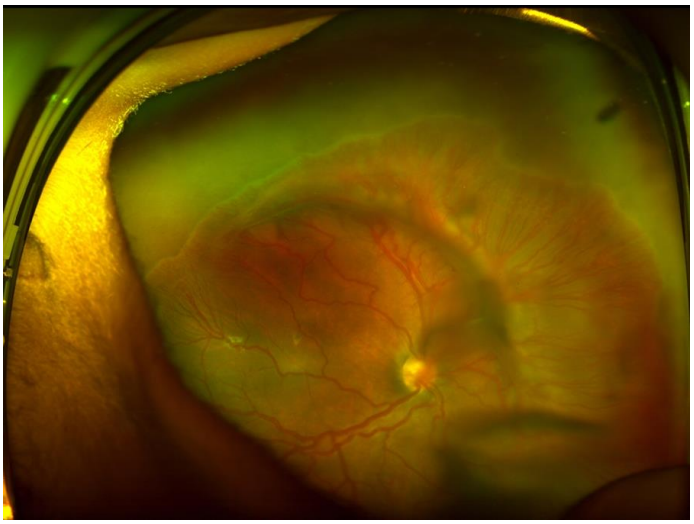
OBJECTIVE To assess the subjective and objective quality of ultra-wide field fundus images (UWFI) in retinopathy of prematurity screening, and to determine the methodology on how to obtain adequate images.

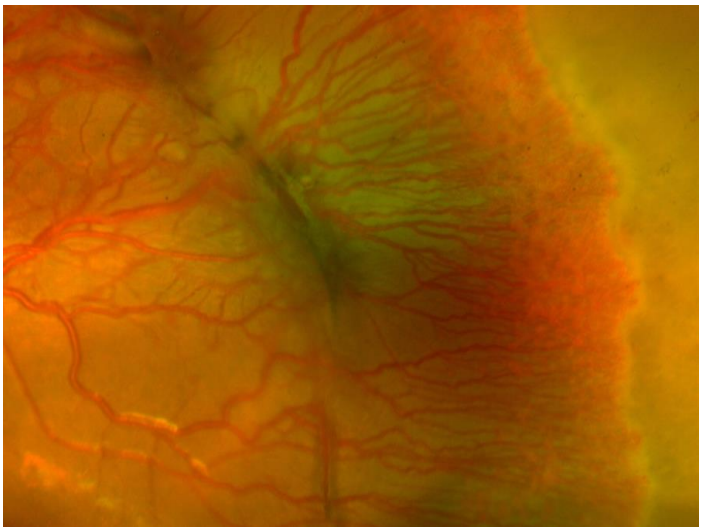
PURPOSE Fundus imaging has improved the quality of care in ROP screening in many aspects. However, traditional contact wide field images may lack definition and sharpness required for a better understanding on the pathophysiology of this disease. UWFI using SLO with simultaneous lasers allows the visualization of minute details on the different stages of ROP.

METHODS Retrospective analysis of UWFI of patients with ROP. Ninety-nine images of 99 eyes were randomly selected for a subjective and objective analysis. For subjective analysis, images were individually observed by two independent graders who determined the zone and stage of each case. Graders were blinded from each other's result. For objective analysis, Cohen's Kappa coefficient was calculated to determine the inter-grader variability of each image, where agreement was defined as values of < 0 as no agreement, 0 – 0.20 as slight, 0.21 – 0.40 as fair, 0.41 – 0.60 as moderate, 0.61 – 0.80 as substantial, and 0.81 – 1.0 as almost perfect.

RESULTS Ninety-nine images were analyzed. Subjectively, in 71 out of 99 images the stage was accurately determined; in 64 out of 99 images the zone was accurately determined. After unblinding the results, both graders could not only observe the stage of ROP, but visualize with more detail the progression/involution of angiogenesis and/or neovascularization. Objectively, grading the stage resulted in an agreement of 0.659, considered substantial agreement; grading the zone resulted in an agreement of 0.650, also considered substantial.

CONCLUSION UWFI can be obtained in ROP patients, with subjectively a higher quality than traditional contact wild-field images. Even if artifacts are present during image acquisition, the information obtained from a section of the UWFI can be enough to determine the stage and evolution in ROP patients, and may have a substantial agreement between experts.





HUMAN RESEARCH This study involves human research.
IRB Approval Status: Exempt from approval

2:01 PM

Evaluation of an Automated Severity Score in Retinopathy of Prematurity

- J. Peter Campbell, MD, MPH
- Robison V.P. Chan, MD
- Michael F. Chiang, MD
- Jayashree Kalpathy-Cramer, PhD
- James M Brown, BSc, MSc, PhD
- Sang Jin Kim, MD, PhD
- Travis Redd, MD, MPH
- Stanford C Taylor, MD
- Kishan Gupta, MD, PhD

OBJECTIVE To evaluate the performance of a deep learning derived automated severity score (i-ROP DL) on telemedicine images for diagnosis and monitoring of clinically significant retinopathy of prematurity.

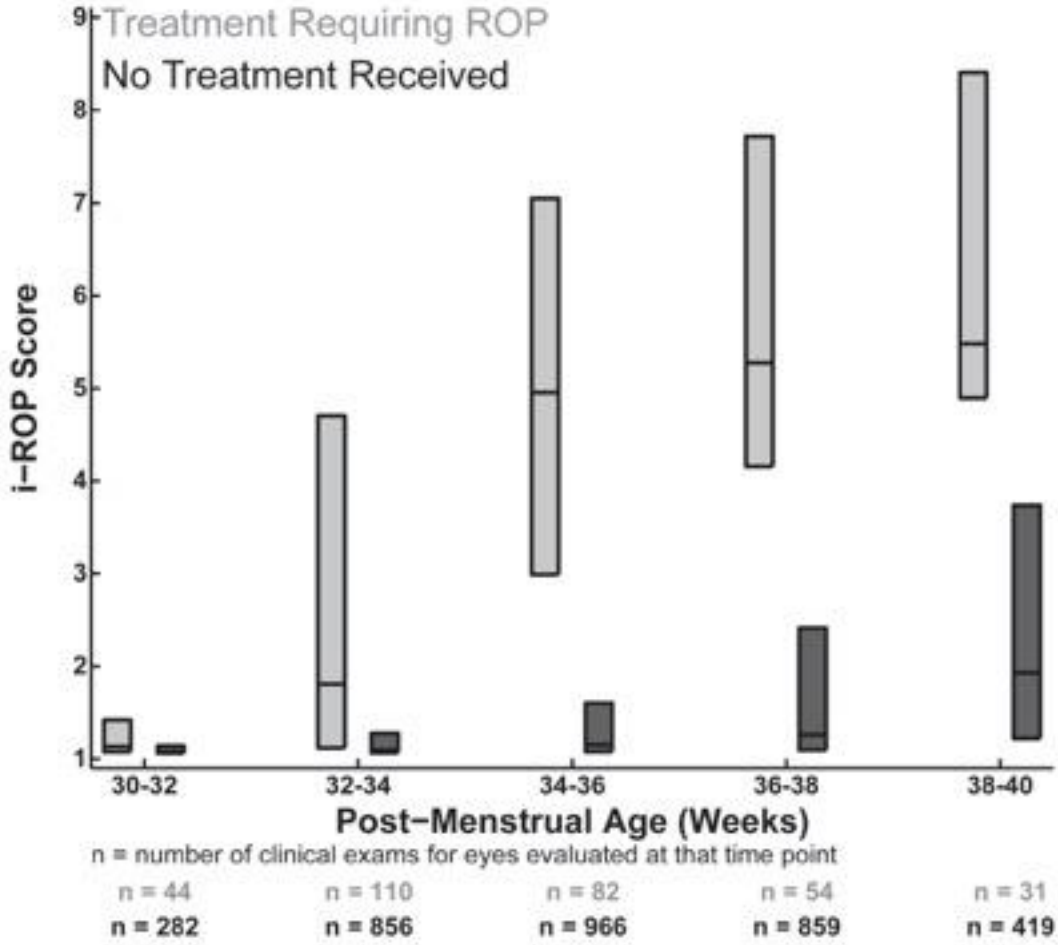
PURPOSE Telemedicine is being increasingly utilized in retinopathy of prematurity (ROP), however graders often disagree on clinically significant disease. Deep learning is being increasingly used in medicine for computer aided diagnosis. We designed a deep learning-based diagnostic system to produce a continuous severity score that can be incorporated as part of a telemedicine system.

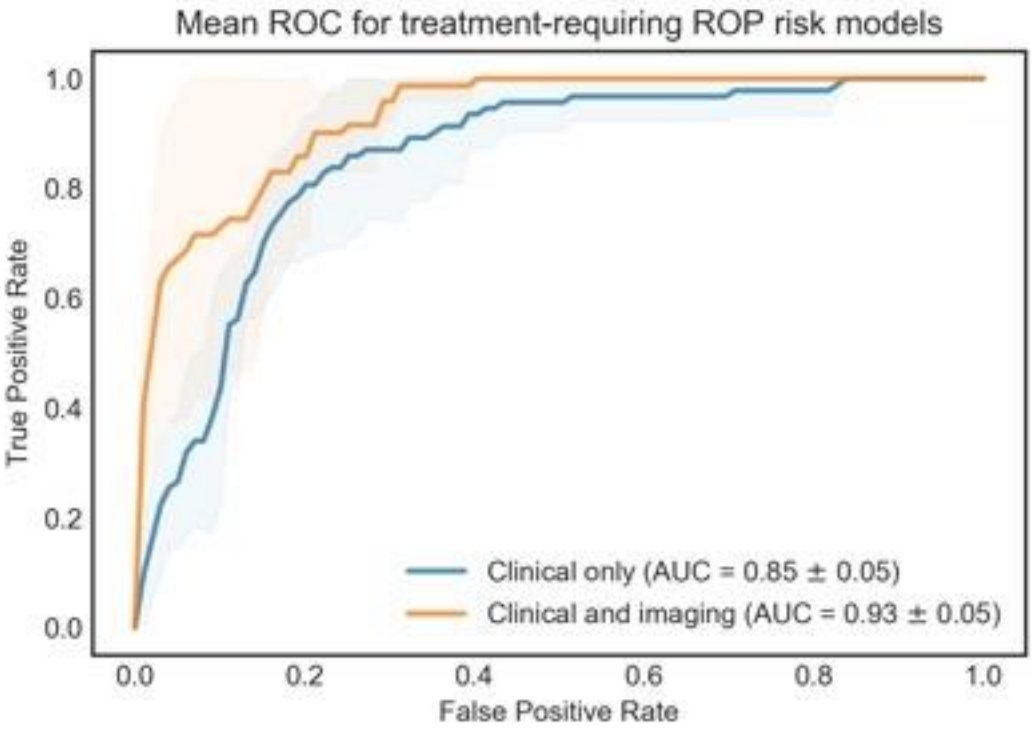
METHODS A multi-institutional dataset of approximately 6,000 posterior retinal photographs was collected as part of the “Imaging and Informatics in ROP” (i-ROP) study. Using 5 fold cross-validation, a deep convolutional neural network (CNN) was trained on each of the training datasets to predict whether an image is ‘normal’, ‘pre-plus’ or ‘plus’ based on a reference standard diagnosis. Using this output, we developed

the i-ROP DL score from 1 (normal vessels) to 9 (severe plus disease). We evaluated this score for the ability to: (1) identify type 2, type 1 ROP and plus disease, (2) monitor disease progression over time, (3) predict the development of type 1, and (4) monitor response to treatment.

RESULTS A total of 5255 clinical examinations in 871 babies (1692 eyes) were analyzed. The i-ROP DL score had an area under the receiver operating characteristic curve (AUROC) of 0.91 for detection of type 2 or worse ROP, and 0.95 for detection of type 1 ROP, and 0.98 for detection of plus disease. 91 eyes (5%) developed type 1 ROP. At all time points, these eyes demonstrated a higher mean i-ROP DL score, and a higher rate of change (95% CI 0.4-1.32 points per week versus 0.07-0.20 points per week), compared to eyes not requiring treatment (Figure 1). Incorporating the i-ROP DL score into a risk model using both clinical and imaging features yielded an AUROC 0.93±0.05 for the future development of type 1 ROP (Figure 2). Finally, 43 eyes were analyzed for pre and post-treatment change in i-ROP DL score. The mean score 2 weeks prior to treatment was 3.9, compared to 7.1 at time of treatment ($p< 0.0001$), and decreasing to 4.0 2 weeks post treatment ($p < 0.0001$).

CONCLUSION The i-ROP DL score is a fully automated deep learning derived severity score for use in ROP telemedicine. These results demonstrate promise for the automated diagnosis of plus disease, monitoring of disease progression, identification of patients at risk for development of type 1 ROP, and monitoring response to treatment in a fully automated fashion as part of telemedicine systems.


Treatment Requiring ROP
No Treatment Received
i−ROP Score
9
8
7
6
5
4
3
2
1
30-32
32-34
34-36
36-38
38-40
Post−Menstrual Age (Weeks)
n = number of clinical exams for eyes evaluated at that time point
n = 44
n = 110
n = 82
n = 54
n = 31
n = 282
n = 856
n = 966
n = 859
n = 419



HUMAN RESEARCH This study involves human research.

IRB Approval Status: Approved by institutional review board

2:14 PM

Fluorescein Angiography Findings Post-intravitreal Bevacizumab for ROP: Can It Predict the Late-Onset Risk of Recurrence?

- Swati Agarwal-Sinha, MD
- Andres Gonzalez, M.D.

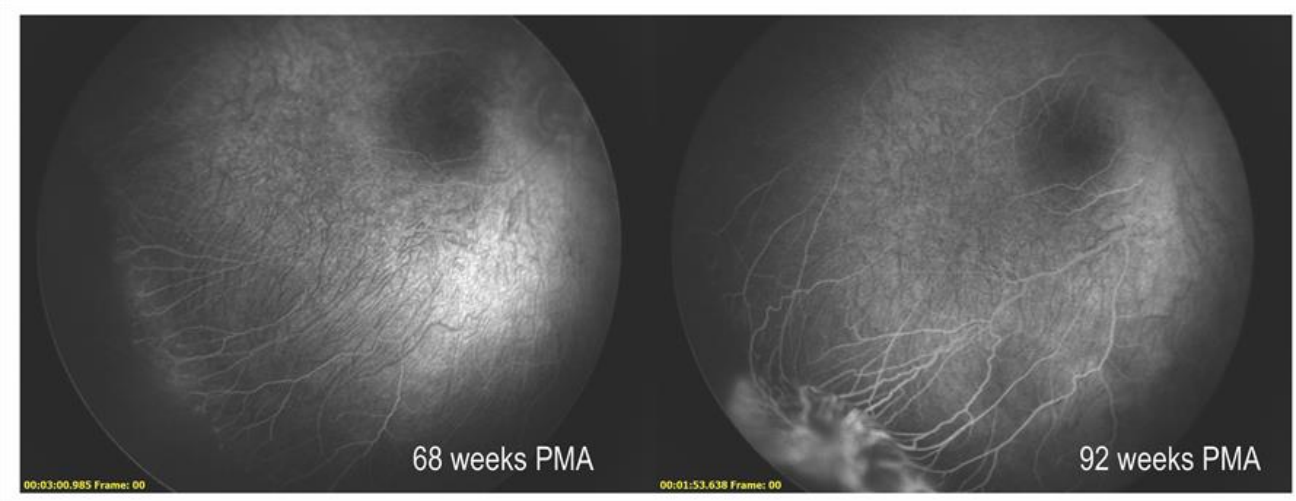
OBJECTIVE To study the unconventional fluorescein angiography retinal findings post-intravitreal bevacizumab in assessing the late onset recurrence of sight-threatening stage 4/5 ROP

PURPOSE Fluorescein angiography (FA) use has documented the retinal vascular changes seen in eyes treated with Intravitreal bevacizumab (IVB) monotherapy for type 1 retinopathy of prematurity (ROP). We studied the retinal vasculature post IVB with FA and assessed the retinal findings imposing a risk for late complications.

METHODS We performed a retrospective, observational clinical study of 22 infants treated for type 1/aggressive posterior ROP (AP-ROP) with IVB monotherapy between 7/2014 to 11/ 2017. Data collection included gestational age (GA), birth weight (BW), postmenstrual age (PMA) at IVB treatment, recurrence of stage 3, number of examinations, adverse events from IVB, FA findings and retinal vascular growth until two years of age.

RESULTS 22 infants treated with IVB monotherapy, had Retcam and FA performed at an average 70 weeks PMA. Of these, 11 infants had repeat FA at an average 98 weeks PMA and three infants at an average 130 weeks PMA. Average GA and BW was 24.6 weeks and 658 grams respectively. Average PMA at first IVB treatment was 37.5 weeks. 7 eyes of 5 infants received repeat IVB for recurrent stage 3 at an average 47.6 weeks. The average number of IVB treatments was 2. All 22 infants continued to show inhibited retinal vasculature in zone 2. 19 of 22 had conventional FA findings which included avascular retina, peripheral leakage, shunts, abnormal vessels branching and tangles. Only three infants showed unconventional FA findings; significant posterior vascular tortuosity, extreme peripheral vascular branching, diffuse hyperfluorescence at the regressed proliferation site. Of the three infants only one had late tractional proliferation at 92 weeks PMA which was treated with barrier laser preserving vision

CONCLUSION Unconventional FA findings seen post-IVB treatment in infants for ROP may need close long-term follow-up for early detection and treatment of late-onset sight threatening complications. A large prospective multicenter study would be beneficial in order to redefine current ROP follow-up examination guidelines post-IVB treatment



HUMAN RESEARCH This study involves human research.
IRB Approval Status: Approved by institutional review board

2:22 PM

Optical Coherence Tomography Angiography in Pediatric Patients

- Lejla Vajzovic, MD
- Cynthia Ann Toth, MD
- Xi Chen, MD, PhD
- S. Tammy Hsu, BA
- Christian Viehland
- Joseph A Izatt, PhD

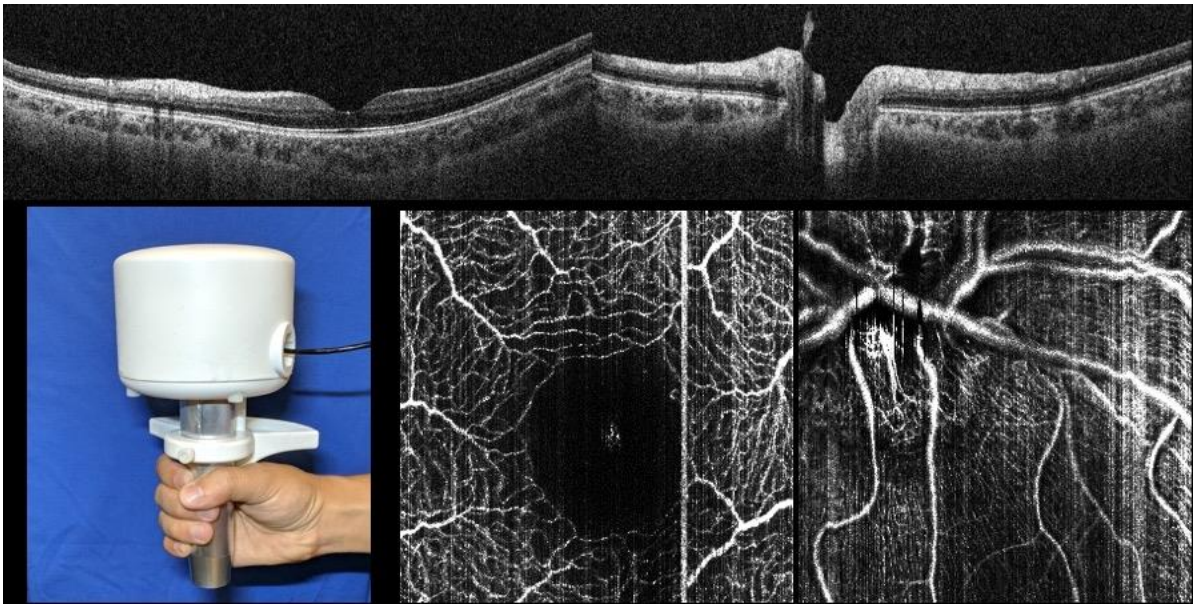
OBJECTIVE Can OCT-A help us define normal and abnormal foveal vasculature in pediatric patients (infants, toddlers, children) with various retinal diseases? Can we develop hand-held wide-field OCT-A device?

PURPOSE Examination of pediatric retinal microvasculature and detection of retinal disease may be aided by noninvasive, high-resolution imaging with OCT-A. Normative data may enable differentiation between normal variance and disease in children, and increase understanding of foveal development. Additionally, development of a novel, wide-field probe capable of hand held OCT-A may allow imaging in infants.

METHODS Under IRB-approved, cross-sectional, observational clinical study, we imaged healthy and diseased maculas of children using investigational Spectralis SD-OCT Flex and tabletop units integrated with OCT-A SP-X1601 algorithm (Heidelberg Engingeering, Germany) while supine in the OR or upright in clinic. Additionally, we developed a custom 200kHz 1060nm hand-held swept source OCT capable of wide-field OCT-A imaging in supine patients. Poor quality images were excluded. We used Matlab and ImageJ to process and measure FAZ area in 10x10° scan angle and 512 B-scans/volume images, and performed preliminary analysis on the effect of age on FAZ using multivariate analyses and linear regression.

RESULTS We imaged 155 eyes of 91 children with Flex (41 eyes of 27 subjects, mean age 2.8±2yrs, range 10wks-7yrs) and tabletop (114 eyes of 64 subjects, mean age 11.5±3.5yrs, range 5-17). Of the eyes imaged, 74 were healthy and 81 had retinal disease. FAZ area was measured in 59 healthy eyes and was not affected by age (p=0.11, multivariate analysis, and R2=0.04, linear regression). Overall, except for 0-3 years, we found greater variability in foveal vascular development within than across age groups. Future analysis will assess the effect of sex, race/ethnicity, and central foveal thickness on FAZ in children. Diseased eyes were qualitatively compared. FAZ was difficult to measure in some eyes with pathology. Lastly, the custom hand-held probe, swept-source wide-field B-scans, and OCTA images of the central macula and peripapillary area of a healthy volunteer are shown in Figure 1.

CONCLUSION We successfully imaged retinal microvasculature in infants and young children using investigational Flex and tabletop OCT-A units in the OR and clinic and have demonstrated supine imaging with novel, hand-held, wide-field OCT-A device. OCT-A of pediatric maculas may provide a basis for assessing foveal development and pathophysiology.



HUMAN RESEARCH This study involves human research.
IRB Approval Status: Approved by institutional review board

2:27 PM

High Magnification Photography and Fluorescein Angiography in Infants With Congenital Zika Syndrome

- Camila V Ventura, MD, PhD
- Audina M. Berrocal, MD
- Mauricio Maia, MD, PhD
- Rubens Belfort Jr MD,PHD, Md PhD
- Liana O Ventura, MD. PhD
- Adriana Gois
- Barbara O. Freire
- Danielle Costa Cavalcante de Almeida

OBJECTIVE To evaluate the retinal and vasculature changes in infants with congenital Zika syndrome (CZS) using high magnification fundus photography and fluorescein angiography (FA).

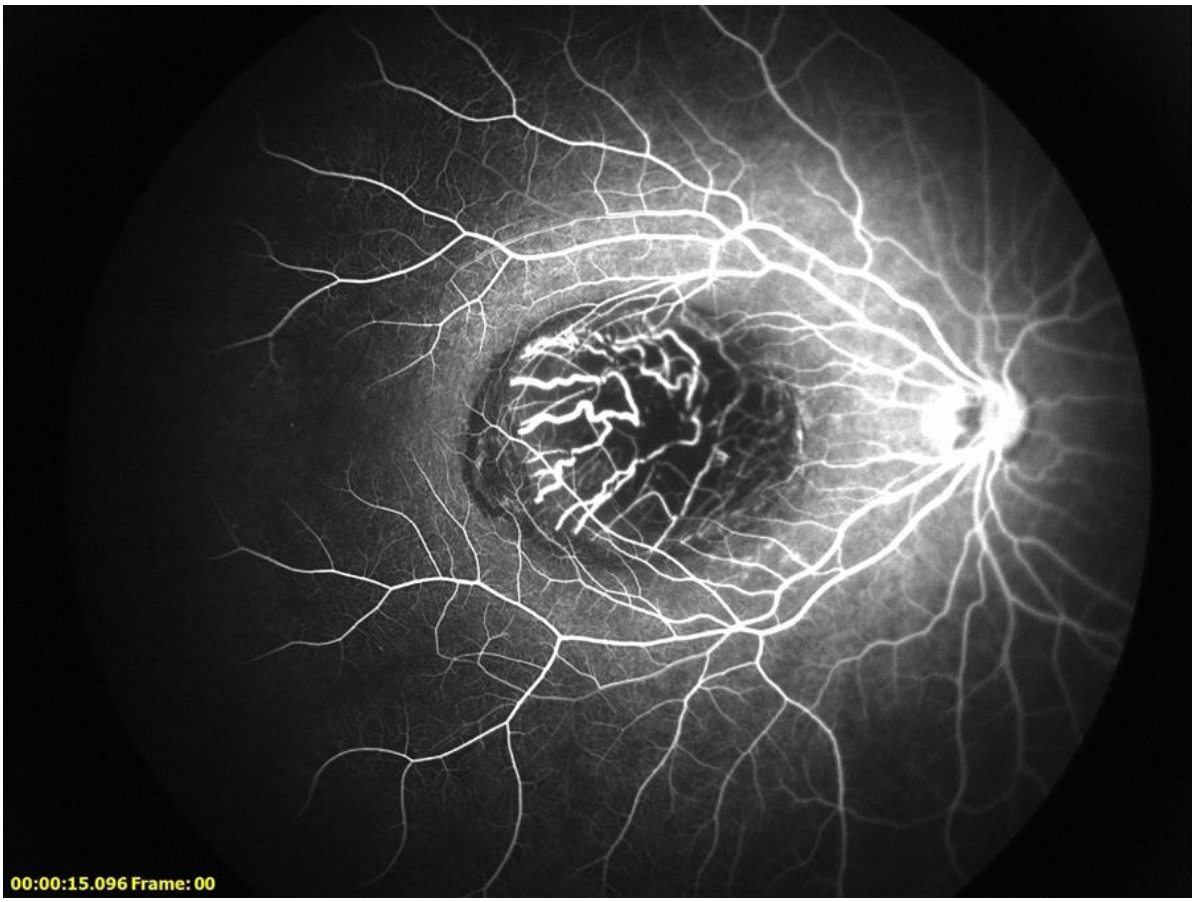
PURPOSE To better evaluate the retinal manifestations of CZS and investigate possible vasculature involvement

METHODS This consecutive case series included five infants with CZS. FA and fundus imaging was performed under anesthesia in both eyes of all infants using a RetCam III® (Natus Medical Inc., Pleasanton, CA) on March 28, 2017. Fundus images were captured using a wide-angle lens (130^{o}) and a high magnification lens (80^{o}) for comparison. IgM antibody capture enzyme-linked immunosorbent assay was positive for the Zika virus (ZIKV) on the cerebrospinal fluid (CSF) samples of all infants. Other congenital infections were ruled out.

RESULTS The infants' mean (SD) age at examination was 1.4 (0.1) years (range, 1.3–1.5 years). Fundus photography using a wide-angle lens detected retinal abnormalities in

seven (30%) eyes and vasculature changes in two (20%) eyes. Fundus photography using a high magnification lens revealed ocular abnormalities in all eyes (100%) and vasculature changes in the same two (20%) eyes. FA imaging highlighted the macular abnormalities in all ten eyes (100%) and revealed vasculature changes in five (50%) eyes. The vasculature changes detected included peripheral vascular abnormalities and nonperfusion in five (50%) eyes and microvasculature abnormalities in three (30%) eyes.

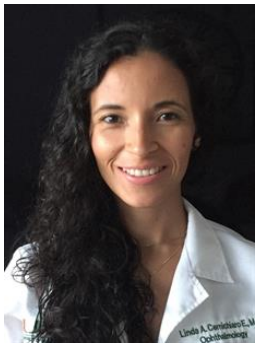
CONCLUSION The ZIKV may affect the retinal vasculature. Retinal and vasculature manifestations in the CZS can be better identified by performing both, high magnification fundus photography and FA imaging.



HUMAN RESEARCH This study involves human research.
IRB Approval Status: Approved by institutional review board

2:32 PM

Report of the Safety and Efficacy of the Use of a Short 32-Gauge Needle for Intravitreal Anti-VEGF Injections for ROP: A Multicenter Retrospective Study



- Linda A Cernichiaro- Espinosa, MD
- Audina M. Berrocal, MD
- Clio Armitage Harper, MD
- Sarah P Read, MD/PhD
- Lauren M Wright, MD
- Frank Scribbick, MD
- Ryan C Young, MD
- Catherin I Negron, MBA
- Annie Rodriguez, RN, RRT

OBJECTIVE Reporting safety and efficacy of the intravitreal injection using a 32g 4 mm needle (short needle) in 218 eyes from two different centers in the United States.

PURPOSE This retrospective review aims to provide the international community a benchmark in safety and feasibility for the use of a short needle for the for intravitreal injection of anti-VEGF drugs in ROP patients from two independent groups. In addition, we detail a safe standard for the implementation of this procedure in neonates.

METHODS A retrospective chart review from the **Bascom Palmer Eye Institute** at the Neonatal Intensive Care Unit of Holtz Children's Hospital; and the **Austin Retina Associates (ARA)** (University Health System Hospital, San Antonio, Texas; Dell Children's Medical Center of Central Texas, Austin, Texas; St. David's North Austin Medical Center, Austin, Texas; Seton Medical Center Austin, Austin, Texas; and Austin Retina Associates) from January 2014 to May 2017 was done. An off-label TSK

STERiJECT (TSK Laboratory, Japan) single-use hypodermic needle, 32g (0.26mm) and 3/16 inch lenght (labeled 4mm; 4.76 mm using conversion tables from inches to mm) was used. Differences between both groups were analyzed.

RESULTS A total of 218 eyes were injected. 94 eyes from BPEI group and 124 eyes from the ARA group. The mean gestational age (GA), mean birth weight (BW) and post menstrual age (PMA) at the moment of injection were 24.43 weeks (±1.46), 623.40 grams (±148.78) and 37.37 weeks (±3.51) in the BPEI group, and 24.65 weeks (±1.44), 671.06 grams (±219.66), and 36.10 weeks (±3.61) in the ARA group. The drug used by the BPEI group was Bevacizumab 0.625mg/0.05mL and by the ARA group was Ranibizumab 0.15mg/0.025mL. At the BPEI vs ARA group: treatment naïve patients were 74.5% vs 91.1%, second injection 16% vs 8.1%, same day as laser 6.4% vs 0.8%, rescue after laser 3.2% vs 0%. At BPEI sweetened pacifier is used at all times without sedation. The *ARA group* performs the procedure with anesthesia at the discretion of the neonatologist (47.6% of the total). No adverse events including corneal ulcer, cataract, endophthalmitis or vitreous hemorrhage were recorded following treatment.

CONCLUSION The short 32g needle was effective in both groups.We document a safe alternative for intravitreal injections that minimizes risk for this increasingly common procedure.

HUMAN RESEARCH This study involves human research.
IRB Approval Status: Exempt from approval

2:37 PM

Surgical Indications, Outcomes, and Complications of Pediatric Endoscopic Vitrectomy in 285 Consecutive Cases

- Aaron Nagiel, MD, PhD
- Unikora Yang
- Emil Anthony T Say, MD
- S. Chien Wong, MBBS,FRCSEd(ophth),MRCOphth
- Thomas C. Lee, MD

OBJECTIVE To report on the indications, outcomes, and complications of endoscopic vitrectomy (EV) in a large cohort of pediatric vitreoretinal patients.

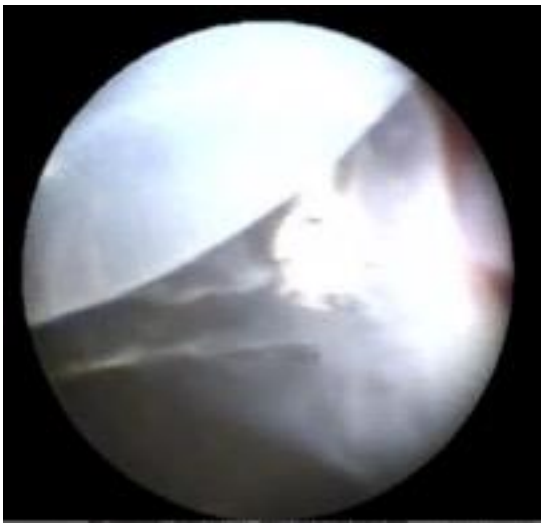
PURPOSE Prior case series have described endoscopic vitreoretinal surgery predominantly in adult patients with a limited range of indications. Here we describe our experience with EV in a diverse group of pediatric patients and pathologies, including those without anterior segment comorbidities.

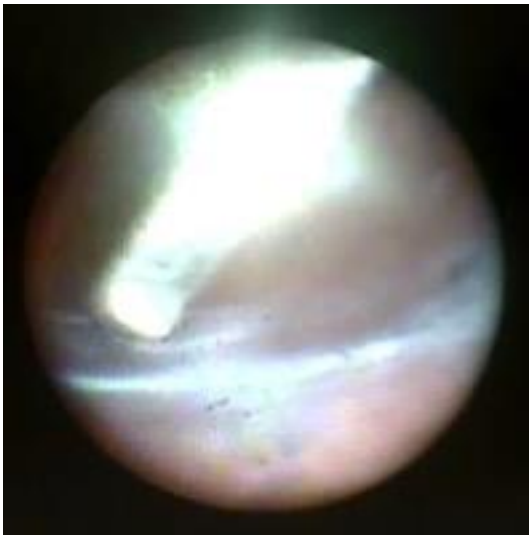
METHODS This is a retrospective review of all patients <19 years old who underwent EV by a single surgeon from 2006-2017. 215 eyes of 187 patients underwent 285

consecutive EVs using 23-gauge vitrectomy (Alcon Constellation) and 19-gauge endoscopy (Endo Optiks). Of the 285 surgeries, 280 were pars plicata/pars plana and 5 were clear corneal. Data collected included demographics, prior ocular histories, pre-operative and post-operative clinical data, and intraoperative techniques. All patients included in the study had a minimum follow-up of 4 months since the last surgery. This study was approved by the hospital Institutional Review Board (IRB#16-00103).

RESULTS 187 patients with a mean age of 7.4 years (range: birth - 18 yrs) and median follow up since last surgery of 34 months (range: 4 mo - 8.7 yrs) were included. The most common indication for EV was retinal detachment (196/285; 69%) with proliferative vitreoretinopathy (132/196; 67%). Other associated diagnoses included trauma (27%), retinopathy of prematurity (14%), pars planitis (7%), and ectopia lentis (7%). 47% of eyes (102/215) had been previously operated elsewhere. Concurrent procedures included silicone oil placement (49%), lensectomy (33%), retinectomy (31%) and scleral buckling (12%). In eyes with pre-operative retinal detachment, including previously operated eyes, retinal reattachment at last follow up was achieved in 65% (99/152). Anatomic success rates were significantly lower for persistent fetal vasculature (36%; p=0.05). Postoperative ocular complications included band keratopathy (23%), hypotony (9%), cataract (6%), and elevated intraocular pressure (5%).

CONCLUSION In this large series of pediatric endoscopic vitreoretinal surgeries, there were good anatomic outcomes and complication rates comparable to previous studies. The endoscope is a valuable surgical visualization instrument with wide applicability especially in pediatric eyes with complex retinal pathology.





HUMAN RESEARCH This study involves human research.
IRB Approval Status: Approved by institutional review board

2:45 PM

Retinoschisis in Coats' Disease: Clinical Picture, Therapeutic Considerations, Management Outcomes and Histopathological Correlation

- Audina M. Berrocal, MD
- Nathan L Scott, MD, MPP
- Linda A Cernichiaro- Espinosa, MD
- Timothy G. Murray, MD, MBA
- J. William Harbour, MD
- Sander R Dubovy, MD

OBJECTIVE To report the clinical and imaging characteristics of retinoschisis associated with Coats' disease and to outline the medical management of eight cases with this rare pathology.

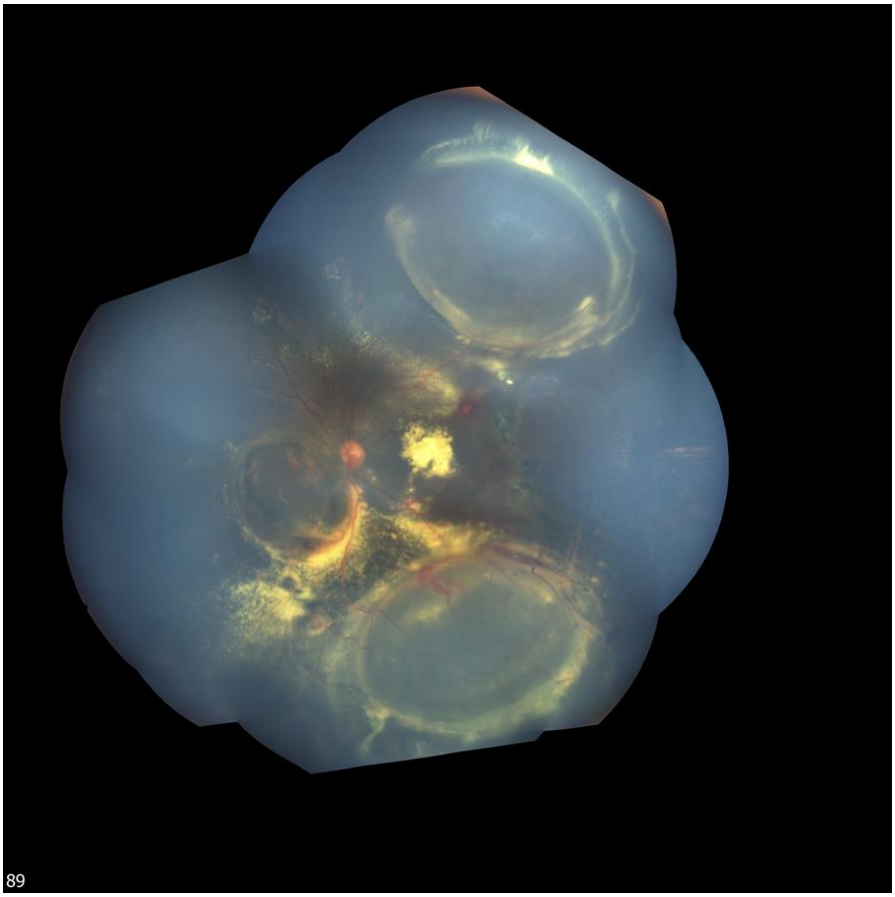
PURPOSE Retinoschisis is a rare clinical finding in Coats disease. It is poorly described in the literature. While the exact pathophysiology is not understood, it may convey clinically significant information. We outline clinical presentation, therapeutic management and clinical outcomes at various stages of Coats' disease with associated retinoschisis.

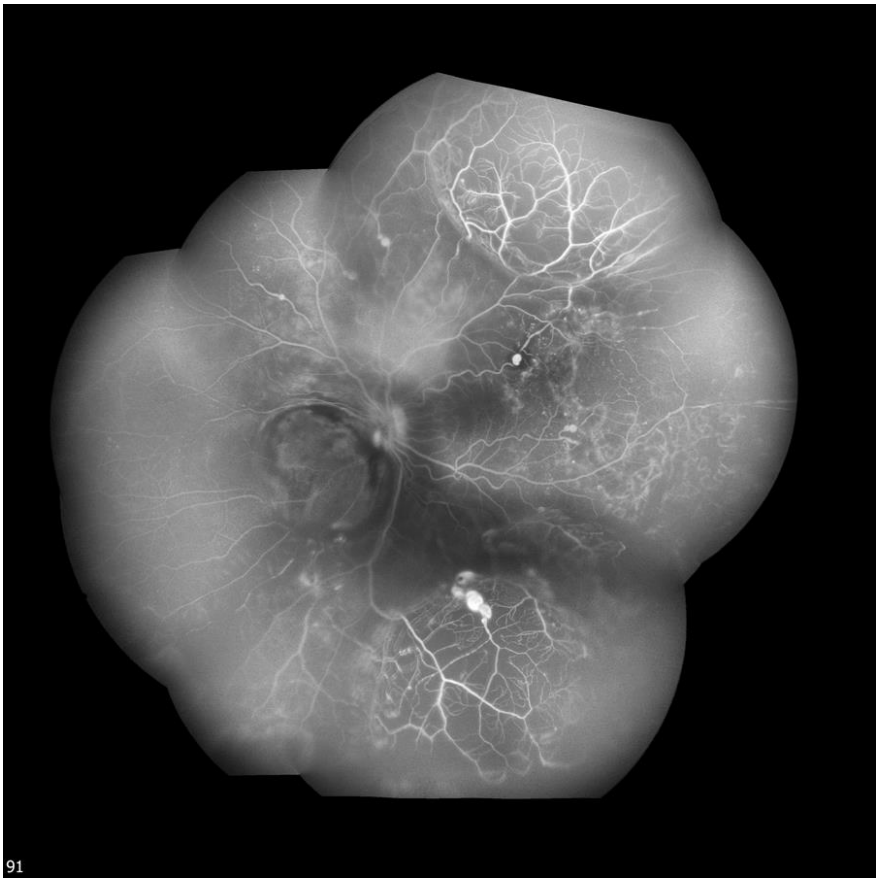
METHODS A retrospective study of patients with retinoschisis associated to Coats disease was performed at the Bascom Palmer Eye Institute. The study was designed in accordance of the tenets of the Declaration of Helsinki and was approved by the Institutional Review Board of the University of Miami (Protocol ID 20110672). Patients with diagnosis of Coats disease by November 2017 with color images were included for the study. Retinoschisis diagnosis was confirmed by the treating physician chart report, color pictures demonstrating schisis cavities and echography confirming hypoechogenic round images consistent with the diagnosis. A minimum follow up of 5 months was required for inclusion.

RESULTS A total of 139 Coats patients were reviewed from the Bascom Palmer Eye Institute. Eight unilateral cases with retinoschisis (diagnosed by color images and B-scan) were included in this series (5 male; 3 female) with a mean age 5.5 years (SD ± 3.2). The mean number of treatments were 6.1 (SD ± 6.3) angiography guided photocoagulation (AGP) sessions, 6.2 (SD ± 8.4) intravitreal injections of bevacizumab (IVB), and 1.3 (SD ± 0.75) sub-tenon's injections of triamcinolone (STT) (Table 1). Two eyes required pars plana vitrectomy (PPV) with scleral buckle (SB) and silicone oil. One case underwent primary enucleation (suspicion of atypical retinoblastoma). Mean follow up was: 28.5 months (range 5 to 77 months). Each case was described in detail, including trajectory of therapeutic management and clinical course highlighted by color images, fluorescein angiography and B-Scan echography (Figure 1). Histopathology of the enucleated eye demonstrated a retinal macrocyst.

CONCLUSION Physiopathology of retinoschisis in Coats is not fully understood. Any attempt to elucidate its behavior will improve final outcomes. AGP, IVB and STT should

be instituted in a step-wise fashion. If the cysts worsen, PPV, SB with membrane peeling without retinotomies is desirable. Long acting endotamponade can allow prompt visualization of the retina and provide longstanding support to the cysts.

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